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EDITORIAL

BAD faith and tyrannical oppression have forced this country and France into a conflict for a cause more just than any for which war has ever been waged. A single purpose and united determination inspire all shades of opinion, since no doubt remains any longer that we have to deal with the greatest threat to progress in the conduct of human affairs that has appeared for centuries.

As we enter the struggle every phase and aspect of civil life must suffer. But if our civilisation is itself to emerge without contamination, this initial disorganisation must be replaced by a systematic effort to preserve the standards which it has attained. In medical matters three things are all-important: the proper provision of care for the sick, the maintenance of well-trained personnel, and continued facilities for learning. Already, in the hurried days of the last month, a great deal has been done to ensure that these matters will be dealt with as they should.

Turning to our own immediate sphere, we know the risks that war entails for any community burdened with tuberculosis. If these risks are to be avoided a close watch will have to be kept on nutrition, contact infection, and the treatment of those already affected; and, in addition, those still engaged in such work, together with those preparing for it, will require continued scope for training and reading. In the hope that some contribution towards the latter may be made the policy of this journal will be to continue publication as usual.

GENERAL ARTICLES

TUBERCULOUS SPLENOMEGALY

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WHILST investigating a series of cases of chronic splenomegaly three cases of tuberculous splenomegaly were discovered, two simulating splenic anæmia and one Hodgkin's disease. It is proposed to present these cases in some detail.

Case Records

CASE I.—E. T., a married woman aged fifty-five years, was admitted to the Medical Unit, Cardiff Royal Infirmary, in June, 1927. For two years she had noticed that she bruised easily and for three months had complained of tiredness, dyspnœa, weakness, pallor, loss of weight and the development of a painless lump in her left side. Three years previously she had a left hemiplegia lasting three months and for thirty years had suffered from rheumatism.

She was pale, but well nourished and afebrile. The spleen was enlarged as far as the iliac crest. The liver was not palpable. A systolic murmur was heard at the apex of the heart, which was otherwise normal. The lungs were normal. There were a few surface bruises. The Wassermann reaction was negative, and a blood count revealed red cells 2,090,000, white cells 3,000. Stained films showed that the anæmia was of the secondary type. An X-ray of the spleen showed no shadow.

A diagnosis was made of splenic anæmia, and it was decided to remove the spleen after preliminary blood transfusions and the surface application of radon over the spleen. The radon (dose, 250 m.c. for seventeen hours) caused a reduction in the size of the spleen, but her general condition did not improve. The day prior to radon application a profuse uterine hæmorrhage occurred, despite the fact that regular menstrual flow had ceased seven months previously (age fifty-four). Bleeding continued for thirty-four days, as a result of which the blood count dropped to: Red cells, 480,000;

white cells, 1,500; Hb, 20 per cent.; the coagulation time was two minutes forty seconds. Vaginal examination showed a bulky retroverted uterus. In spite of four blood transfusions she got steadily worse and was now obviously unfit for splenectomy. Accordingly, radium was inserted into the uterus on September 19, 1927, and ten days later the vaginal bleeding ceased. Thereafter she improved considerably, and was able to leave hospital on January 30, 1928, the spleen then being at least half its original size and the blood count being as follows: Red cells, 2,495,000; white cells, 1,000; Hb, 40 per cent.

Two months later her symptoms returned and she was readmitted to hospital on April 27, 1928. The spleen was enlarged as previously, but in addition she now had slight ascites and a rise in temperature to 99° F. A further blood count showed: Red cells, 2,860,000; Hb, 50 per cent.; white cells, 1,000—polymorphs, 34 per cent.; lymphocytes, 60 per cent. The red cells were pale and showed marked variation in size and shape; no nucleated forms were seen. With rest in bed and treatment with liver and orange juice her general condition improved and she was discharged on June 19, 1928. However, six weeks later the ascites had increased to such an extent that the abdomen was tapped on two occasions, 12 pints and 7 pints of ascitic fluid respectively being withdrawn. Unfortunately, no pathological report is available. The spleen was about half its original size and the blood count had slightly increased to 4,080,000 red cells, and 54 per cent. Hb. By January, 1929, her condition had improved still further, and apart from the splenomegaly and a few disappearing bruises on the legs there were no other abnormal signs. At this time her blood count was: Red cells, 4,820,000; Hb, 74 per cent.; white cells, 2,000; platelets, 80,000. The coagulation time was eight to eleven minutes. On February 4, 1929, splenectomy was performed by Professor A. W. Sheen.

Operative Findings.—The spleen and liver were studded with numerous slightly raised yellowish-white nodules, varying in size from a pin's head to about 2 cm. There were universal adhesions around the spleen except on its anterior surface, and a slight amount of ascitic fluid in the abdomen. It was noted that the stomach had a number of white nodules on its surface, similar to those on the spleen and liver. Some of the liver nodules looked like cancer, and one was removed for further examination. On account of the adhesions, splenectomy was performed with great difficulty.

The spleen (Fig. 1) weighed 2 lbs. 3 oz. It showed a large infarct at its upper posterior angle, from which a yellowish-white, raised, finger-like process extended over the capsule. The surface was universally studded with nodules, and where the capsule was stripped it was very red and soft.

She made an excellent recovery. The blood count on March 19, 1929,

was: Red cells, 5,230,000; white cells, 4,200; Hb, 75 per cent.; platelets, 207,000.

Report on Microscopic Examination—1. *Band on Spleen* (Fig. 2).—This is an extra-capsular tuberculous nodule formed upon the peritoneal surface. It shows central caseation and peripheral dense fibrosis with active tubercle in some areas.

2. *Nodule on Surface of Spleen*.—Peritoneal tubercles.

3. *Spleen* (Fig. 3).—The organ generally is hyperplastic and the hyperplasia affects chiefly the splenic pulp. The trabeculae are thickened, as are the branches of the splenic artery. There is a diffuse infiltration of the pulp with leucocytes, including a number of polymorphs, and a great increase in the endothelial cells. Scattered throughout the spleen are a number of small typical tubercles. The Malpighian bodies are slightly atrophic.

4. *Nodule on Liver*.—Fibrous and active peritoneal tubercles. Akin to the nodules on the spleen.

5. *Hilum Gland*.—Typical diffuse active tuberculosis.

Subsequent Progress.—When seen three years after splenectomy she looked extremely well; she had no further hæmorrhages and there were no abnormal signs. Four years after splenectomy the blood count was as follows: Red cells, 6,000,000; Hb, 80 per cent.; white cells, 7,000; platelets, 500,000. Seven years after splenectomy she was perfectly well apart from arthritis of the hip joint; an X-ray of the chest showed no evidence of any disease. The blood count was as follows: Red cells, 5,180,000; Hb, 80 per cent.; white cells, 9,800. She was last seen in January, 1939—that is, ten years after splenectomy. Her general condition was extremely satisfactory and she had no symptoms or signs apart from arthritis of the hip. Another blood count showed: Red cells, 5,000,000; Hb, 100 per cent.; white cells, 8,600—polymorphs, 52 per cent.; lymphocytes, 38 per cent. The red cells were well stained and normal in size and shape; no abnormal red or white cells were seen.

Comments on Case 1.—The patient presented the clinical features of splenic anæmia associated with subcutaneous hæmorrhages, uterine bleeding, and a low platelet count. The uterine bleeding was controlled successfully by radium. The surface application of radon to the spleen caused an appreciable reduction in its size, but no improvement in the anæmia or general condition. The tuberculous nature of the splenomegaly was not suspected until microscopic examination after splenectomy. Although tuberculous deposits were found on the liver and stomach, she made an excellent recovery and was in perfect health ten years after the operation.

CASE 2.—F. McD., a single woman, aged thirty-three years, admitted to the London Hospital in January, 1926, with enlargement of the spleen

PLATE XXXI



FIG. 1.—PHOTOGRAPH OF SPLEEN FROM CASE 1, SHOWING AREA OF INFARCTION IN THE UPPER POLE, WITH FINGER-LIKE EXTRACAPSULAR TUBERCULOUS NODULE BELOW IT, AND ALSO SURFACE TUBERCLES.

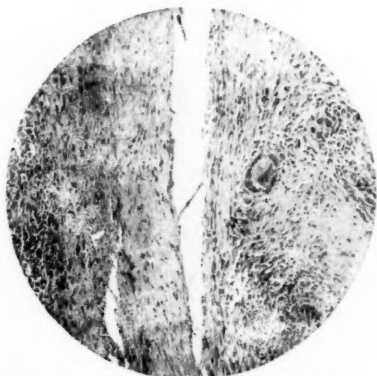


FIG. 2.—MICROPHOTOGRAPH, $\times 75$: SPLEEN FROM CASE 1, SHOWING TUBERCULOSIS OF CAPSULE WITH GIANT-CELL FORMATION.

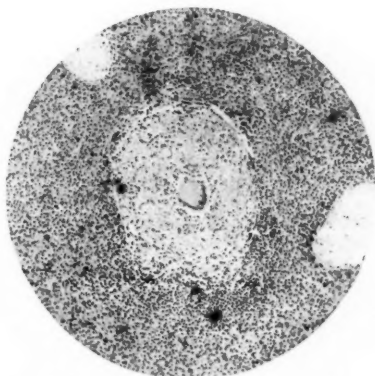
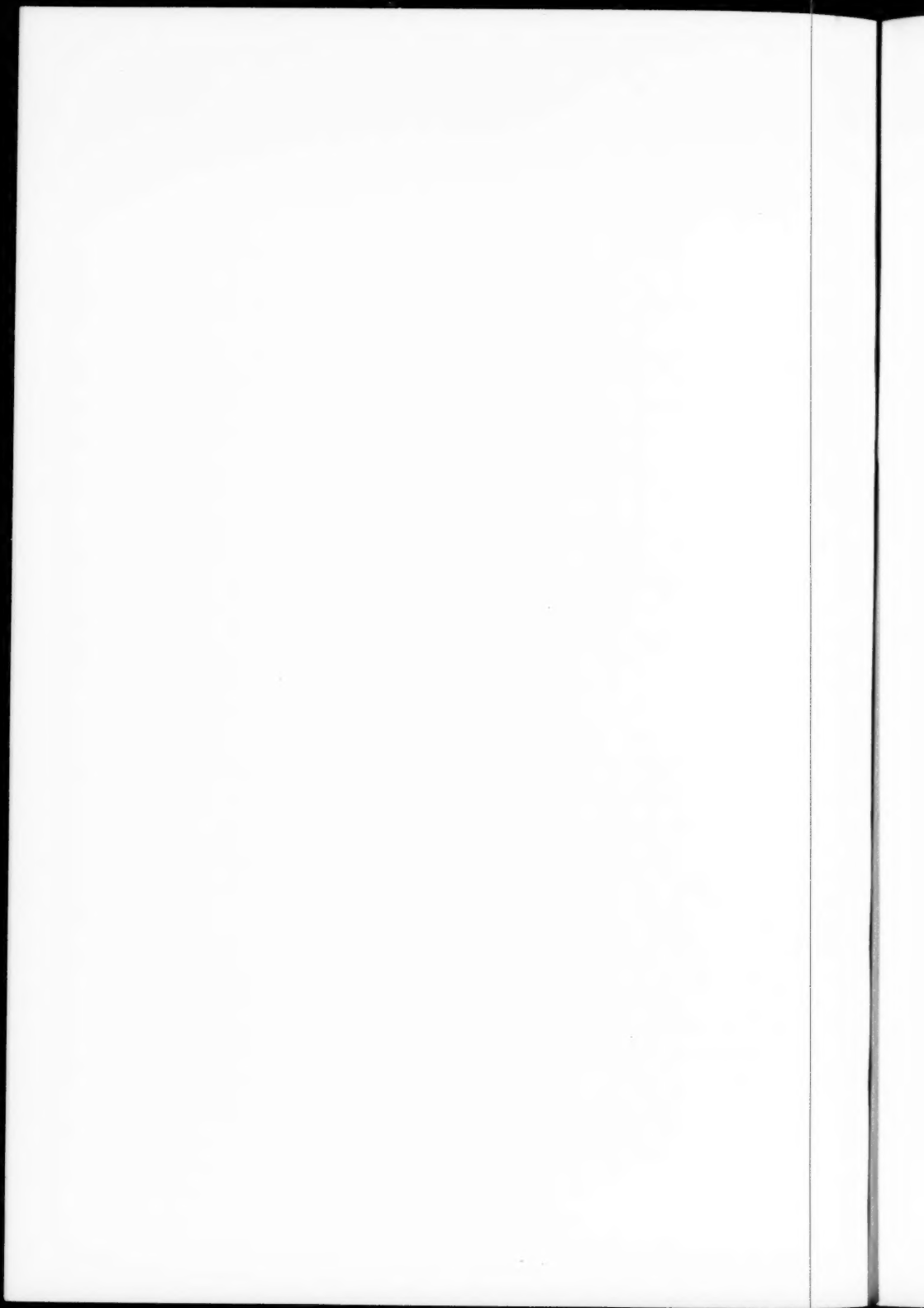


FIG. 3.—MICROPHOTOGRAPH, $\times 75$: CASE 1, TUBERCULOSIS OF SPLEEN.

[To face page 180.]





to the level of the umbilicus, slight enlargement of the liver, gross ascites and anæmia. There were no abnormal signs in the lungs or heart, but unfortunately an X-ray of the chest was not taken.

Past History.—In 1907, at the age of fourteen years, an operation was performed for tuberculous peritonitis. There were several caseous glands present, but no mention was made of the spleen at that time. A few months later she was readmitted for the treatment of a tuberculous sinus, which healed with conservative treatment. In 1910 an operation was performed for a ventral hernia, during which it was noted that she no longer had ascites and no abdominal mass could be seen or felt. In 1921 she vomited $\frac{1}{2}$ pint of blood, and in 1925 she had four severe hæmatemeses. A blood count in January, 1926—that is, about four months after the last hæmatemesis—was: Red cells, 2,500,000; Hb, 30 per cent.; C.I., 0.6; white cells, 2,880—polymorphs, 73 per cent.; lymphocytes, 18 per cent. The urine was normal. The clinical features suggested a diagnosis of Banti's syndrome and splenectomy was advised.

Splenectomy was attempted in January, 1926, but the operation had to be abandoned because the spleen was bound down by dense adhesions, making removal impossible. The liver was also enlarged and a considerable amount of free fluid was present in the peritoneal cavity; there were numerous dense adhesions, presumably due to the previous attacks of tuberculous peritonitis, causing obstruction to the splenic vein and portal circulation.

The lassitude, weakness, shortness of breath, swelling of the abdomen and pain over the spleen persisted. In May, 1933, the spleen was still palpable at the level of the umbilicus and the liver was slightly enlarged, but there were no other abnormal physical signs. At this time the results of further investigations were as follows: *Blood count:* Red cells, 3,500,000; Hb, 46 per cent.; C.I., 0.56; white cells, 3,200—polymorphs, 70 per cent.; lymphocytes, 23 per cent.; platelets, 31,000; reticulocytes, 2 per cent. *Red cell fragility test:* Normal. *Wassermann reaction:* Negative. *Blood cholesterol:* 0.1 gr. per cent. *Van den Bergh reaction:* Direct, negative; indirect, less than 0.1 mgrm. per cent. Bleeding time, four minutes thirty seconds. Coagulation time, one minute fifty seconds. Slight excess of urobilinogen in the urine.

Pil. ferri 90 gr. daily was administered for the first time on May 19, 1933. No improvement was noticed until November, 1933, but on December 11, 1933, the blood count was normal: Red cells, 5,100,000; Hb, 95 per cent.; C.I., 0.95; white cells, 3,600; platelets, 61,200. She was able to lead a more or less normal life for the first time in many years, despite the fact that the enlargements of the spleen and liver persisted. Blood count February 2,

1934: Red cells, 5,100,000; Hb, 95 per cent.; white cells, 4,200. In July, 1939, she was in comparatively good health. At intervals there had been swelling of the abdomen followed by either hæmatemesis or melæna, but she had always improved with iron therapy. There had been no evidence of pulmonary disease. At the end of July, 1939, however, she had another hæmatemesis which proved fatal. Unfortunately a necropsy was not possible.

Comments on Case 2.—Adhesions remaining from an attack of tuberculous peritonitis produced obstruction to the portal and splenic veins, causing enormous enlargement of the spleen and ascites and simulating Banti's syndrome. An attempt at splenectomy had to be abandoned because of the adhesions, so that further details regarding the condition of the spleen are not available, which makes it doubtful whether the spleen itself was tuberculous.

Although the spleen was not removed, the anæmia responded to iron therapy and the patient was alive and in comparatively good health thirteen years after first coming under observation. Another hæmatemesis then proved fatal.

CASE 3.—G. B., a male aged eighteen years, was admitted to Cardiff Royal Infirmary on May 8, 1928. In 1921 his attention was drawn to the existence of a small hard lump in the right mandible, later followed by smaller lumps on both sides of the neck. In 1923 at another hospital some of the lumps on the right side of the neck were removed, and in 1925 those on the left side were also removed. About the same time further lumps appeared in the axillæ and groins. There were no constitutional symptoms whatsoever. Unfortunately no further reports regarding his condition at that time are available. In 1928 his general condition was good. There was slight enlargement of the lymphatic glands on both sides of the neck, axillæ and groins. The spleen was palpable two finger-breadths below the left costal margin. No abnormal signs were found in the heart, lungs, or nervous system. The temperature occasionally reached 99° to 100°. On clinical grounds a diagnosis of Hodgkin's disease was made, but later the report on an excised gland showed that the condition was tuberculous. Two months later he developed a cough, lost weight, and other constitutional symptoms of tuberculosis appeared. His general condition became very much worse, and the temperature varied from 97° to 101°. He was cyanosed, slightly dyspnoëic, the percussion note at the apices of both lungs was impaired, and moist sounds could be heard throughout the chest. An X-ray of the chest showed typical miliary tuberculosis affecting both lungs, and also enlargement of the heart. He died in March, 1929.

Necropsy Examination.—The pericardium was entirely adherent with a large layer of tough fibrin. The heart was generally enlarged. The whole

mediastinum was solid and matted together, with chronic inflammation in which many tuberculous glands were seen.

The pleura on both sides was adherent with firm old adhesions. The whole of both lungs was thickly studded with tubercles in different stages of softening.

The abdominal cavity contained a large amount of free straw-coloured fluid. The spleen was enlarged to about four times and was studded with tuberculous nodules.

The lymph glands in the neck, mediastinum and mesentery were all enlarged, some being soft and caseous and some calcified. The kidneys contained several tuberculous nodules. Microscopic examination showed miliary tuberculosis involving the lungs, kidneys, lymph glands, liver and spleen.

Comments on Case 3.—For seven years this patient had generalised enlargement of the superficial lymphatic glands, with enlargement of the liver and spleen. The clinical condition suggested Hodgkin's disease, but microscopic examination of an excised gland proved that it was tuberculous. There was a terminal miliary dissemination involving the lungs, kidneys, liver, lymph glands, and spleen.

Discussion

Incidence of Tuberculosis of the Spleen.—Tuberculosis of the spleen is a not uncommon necropsy finding. Klotz (1917), in a series of 404 necropsies in people over ten years of age, found tuberculosis in 172 cases; the spleen was involved 69 times, and in 12 of these there was no evidence of tuberculosis in other organs; in none of the cases was the spleen enlarged; he concluded that splenic infection was a hæmatogenous one, arising most commonly from antecedent foci in the lungs or peribronchial glands. Hoyle and Vaizey (1937), analysing 110 cases of chronic miliary tuberculosis, found that by far the most frequent evidence of hæmatogenous dissemination of tuberculosis elsewhere than in the lungs was in the spleen; enlargement of the spleen occurred in no less than 31 of their cases, and in 3 it was so great that splenectomy was performed. The publications of the South African Institute of Medical Research (1932) have shown that no less than 51 per cent. of natives dying of pulmonary tuberculosis had evidence of the disease in the spleen. Amongst tuberculous children the frequency of splenic involvement has been given as 40 per cent. by Ghon (1926) and 66 per cent. by Winternitz (1912).

In most of the above cases the splenic involvement was of secondary importance to active disease elsewhere. Sometimes, however, the original tuberculous focus heals and the disease localises itself to the spleen, which

becomes enormously enlarged and may itself act as a focus of dissemination to other organs. The term "primary tuberculosis of the spleen" which has been applied to such cases is misleading, because a careful search will nearly always reveal evidence of healed or active tuberculosis elsewhere. For instance, Winternitz (1912), analysing fifty-one cases of so-called primary tuberculosis of the spleen collected from the literature, found that there was tuberculosis of the liver in 80 per cent. of cases in which it was examined; in 57 per cent. of the cases in which the glands were examined more or less tuberculous involvement was found; in 40 per cent. of cases examined the lungs showed evidence of tuberculosis; tuberculosis was found elsewhere in 66 per cent. of the cases. On the other hand, authentic reports of cases where the disease has been confined to the spleen are exceptional. It occurred in only one of Winternitz' series of fifty-one cases, and in only one of several hundred reported in the publications of the South African Institute of Medical Research. Cynman (1930) reported one case of his own and five others collected from the literature, and Hodges (1930) has described another where there was no evidence of tuberculosis elsewhere.

It is thus evident that the term "primary tuberculosis of the spleen" is undesirable, and accordingly most authors now refer to the condition as tuberculous splenomegaly. In this condition the original focus of tuberculosis has healed or other foci are of definitely secondary importance to the splenic involvement.

Clinical Features of Tuberculous Splenomegaly.—There are no characteristic clinical features by which tuberculous splenomegaly may be diagnosed with certainty. Reports of cases correctly diagnosed prior to operation or post-mortem are few (Magnac, 1924; Shands, 1933; Giffin, 1919; Moorman, 1937; Engelbreth-Holm, 1938).

The sexes appear to be equally affected. Although no age is exempt, it is found most frequently between the ages of twenty and forty years. Splenomegaly, usually of considerable degree, is the only constant sign, but there is nothing to distinguish it from an enlarged spleen due to other causes. Symptoms such as pain, dyspnoea, emaciation, fever, dyspepsia, gastrointestinal hæmorrhage, etc., may be present and cause the patient to seek advice in the first instance. The blood picture is inconstant and any type of blood change may be encountered. Both the red cells and the white cells may be normal, increased or diminished, depending upon the bone-marrow reaction. The commonest finding is a low colour index, anæmia with leucopenia and relative lymphocytosis. The frequency of polycythæmia with cyanosis is often emphasised, but there is little doubt that anæmia is the more common finding.

Diagnosis.—The diagnosis may be suspected when there is evidence of

tuberculosis in other organs, particularly in the lungs, or a tuberculous family history.

Considerable importance has been attached to the diagnostic significance of calcification of the spleen as seen in the X-ray picture, although some doubt has been expressed as to whether these changes are due to calcified venous thrombi or calcified tubercles. Moorman (1937), in a review of the literature, discovered reports of 24 cases of calcified nodes in the spleen observed during life by X-ray. Of these, 12 were diagnosed as phleboliths and 12 as representing calcified tubercles; practically all the cases reported as being due to tuberculosis were proved correct later by laboratory studies after splenectomy or at autopsy; the X-ray portrayal of nodes, later proved to be of tuberculous origin, was in every respect similar to those reported as phleboliths. The author concluded that the weight of evidence seemed to be in favour of regarding these findings as evidence of tuberculosis. Berman (1937) has described 18 cases of miliary calcification of the spleen discovered accidentally during the course of X-ray examination of the chest and abdomen, although 11 of these gave no clinical history of tuberculosis. Shands (1933) was able to make a correct diagnosis by this means in three patients prior to operation, which prompted him to suggest that a correct diagnosis may be made in the vast majority of cases.

Radiological examination of the spleen and of the chest should be a routine investigation in all forms of splenomegaly of doubtful ætiology. Some writers even suggest that an X-ray of the spleen should be taken in all cases of pulmonary tuberculosis.

Difficulties in diagnosis occasionally arise through the varied and inconstant blood changes that may occur. Recorded cases show that this disease may simulate *pernicious anæmia* (Engelbreth-Holm, 1938; Giffin, 1919), *polycythæmia* (Mouriquand, 1935), *aplastic anæmia* (Giffin, 1919), *hemolytic anæmia* (Giffin, 1919), *acholuric jaundice* (Engelbreth-Holm, 1938), *myeloid leukæmia* (Giffin, 1919), and *hemorrhagic purpura* (Kellert, 1931). Furthermore, it often resembles other diseases associated with chronic splenomegaly. *Hæmatemesis* and other features characteristic of splenic anæmia and Banti's syndrome have been observed in several cases of tuberculous splenomegaly (Engelbreth-Holm, 1938; Bunch, 1931; Price and Jardine, 1931; Hickling, 1938). A case reported by Bunch (1931) had two lesions in the spleen, one typical of Banti's syndrome and the other of tuberculosis. Other diseases for which tuberculous splenomegaly has been mistaken include Hodgkin's disease (Pether, 1937) and syphilis (Gouriou, 1936).

Treatment.—Splenectomy is the treatment of choice in the majority of cases, although it is wrong to suppose that unless so treated the disease

must necessarily prove fatal. The results are governed to a certain extent by the degree of involvement and activity of the disease elsewhere, particularly in the lungs. On the other hand, lesions outside the spleen often react favourably to conservative treatment once the spleen has been removed.

Winternitz (1912) concluded that death invariably followed if the spleen was not removed, and he regarded the condition as an absolute indication for splenectomy, even though the process may have reached the liver or lymph nodes; 59 per cent. of his series recovered after the operation. Of the 28 cases collected from the literature by Engelbreth-Holm (1938), 16 were operated upon; 14 survived the operation, but of these 7 died of tuberculosis of the lungs or generalised tuberculosis sooner or later. Henschen (quoted by Cynman) recorded 20 cures and 9 deaths out of 29 cases operated upon. Magnac (1924), who collected 18 cases from the literature, to which he added one of his own, found an incidence of 67 per cent. recovery after splenectomy. In addition to these, there are numerous isolated case reports claiming favourable results after the operation (Cynman, 1930; Giffin, 1919; Hickling, 1938; Gloor, 1935; Shands, 1933; Bunch, 1931; Kellert, 1931; Fassrainer, 1935).

As an alternative to splenectomy deep X-ray therapy or radium has been tried, but the reported results are not convincing (Engelbreth-Holm, Gloor, Cynman).

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SEASONAL TRENDS IN PULMONARY TUBERCULOSIS

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I.—SEASONAL VARIATION IN THE EXPECTORATION OF SPUTUM

THERE are two main avenues for investigating seasonal variation in disease. The first is to select some incident in the course of a certain disease, and in a large series of cases ascertain if that incident be more prone to occur at one time of the year than another. This method was used by the writer (1939) in describing the seasonal change observable in swelling and in pus formation in tuberculous glands. The second is to focus attention upon a smaller series of patients, making frequent observations throughout a complete year, and analysing the results on a seasonal basis. This method was adopted by the writer (1937) in describing the seasonal trends present in body weight and body temperature in tuberculous subjects, and has also been employed in this inquiry on seasonal changes in the expectoration of sputum in pulmonary tuberculosis.

Unfortunately the detection of seasonal change in pulmonary tuberculosis is not so simple as it was found to be in lymphatic tuberculosis, and only indirect evidence has hitherto been available. Thus Redeker (1931) stated that initial symptoms of pulmonary tuberculosis were noted most frequently in May and June. He argued that six weeks to two months were usually required for a lesion to manifest itself symptomatically, and

that tuberculous lesions commonly became active, therefore, during March and April.

In the present work an endeavour was made to ascertain if the amount of expectoration in patients suffering from pulmonary tuberculosis varied according to season by carrying out in a series of forty-one cases daily measurements for at least one complete year.

Methods

(a) *Selection of Cases.*—The clinical material for this investigation consisted of every sputum-positive patient in residence at Southfield Sanatorium Colony, Edinburgh, for at least one complete year between January, 1932, and December, 1937, excepting those who were treated by any of the forms of collapse therapy, and those who developed pleurisy with effusion or spontaneous pneumothorax. In those cases which ended fatally the data for the last two months before death were not included, though in all of them readings for a complete year were available. The necessity for these conditions governing the selection of cases is obvious, since all four possibilities would mask any seasonal change by directly increasing or decreasing the amount of sputum. In connection with the last of these points the amount of sputum diminishes in the last weeks before death because the patient has insufficient strength to expectorate it. Apart from these considerations, however, no selection was made. Every case was included, provided only that the sputum had been measured daily for at least twelve consecutive months. There were forty-one such cases.

(b) *Technique of Measuring Sputum.*—Each morning the contents of the patient's flask or flasks were emptied into measuring cylinders of 100 c.c. capacity, and were allowed to sediment for five minutes. During this time the sputum settled to the bottom, and the froth and saliva rose to the top. The amount of sputum was read off and (after deducting 15 c.c., which was the amount of carbolio acid always placed in a sputum flask before use) the result was recorded.

(c) *Analysis of Data.*—From the collected data the average daily output of sputum was calculated in each case for each month of the year. This figure was then expressed as a deviation above or below the mean for the whole year. An average deviation from the mean for the whole group of cases was then calculated. In those cases which were under observation for more than one year there were, of course, two sets of readings for each month in excess of the year; the average of these two sets of readings was then taken as the starting point of the above calculations. This device seemed permissible, since, in those cases which were undergoing treatment

for more than one year, no special sequence of months was characterised by duplicated data.

(d) *Possible Fallacies attaching to this Method.*—The above method is not devoid of fallacy unless provision be made for certain pitfalls. These may be classified as follows: (1) Errors in measurement; (2) method of statistical analysis; (3) special clinical features—*e.g.*, cavitation and bronchitis; (4) confusion of a possible seasonal trend with results of treatment. It is proposed briefly to examine these points.

1. *Errors in Measurement.*—Anyone who has attempted to measure the volume of expectoration knows well that it is not a simple matter. Where sputum is small in amount little error is likely to be encountered, but in cases where it is very copious different observers may examine the same specimen and record figures which vary as much as 10 per cent. one from another. For this reason readings taken once or twice a week would be useless, but where the volume was recorded daily for a year, as in this investigation, and for long periods by the same observers, it is believed that such errors would be minimised.

2. *Method of Statistical Analysis.*—In analysing the collected data the method of calculating deviations from the mean does not represent completely adequate statistical analysis of the results. The biometrician would probably compare the day-to-day variation with the month-to-month variation before drawing conclusions as to the seasonal trends in the output of expectoration. The labour involved for a review of forty-one cases in this way is, however, enormous; the method adopted is reasonably accurate provided that attention is devoted to individual cases in a less complicated manner to ascertain the actual numbers exhibiting seasonal change (*vide infra*).

3. *Special Clinical Features.*—Patients suffering from early pulmonary tuberculosis have only scanty sputum, which is easily measured, with little day-to-day variation. But in those with cavities there is more variability, whilst in patients with much superadded bronchitis the sputum fluctuates considerably in amount. Thus in analysing the results it is necessary to devote attention to these three types of cases in assessing the presence or absence of seasonal change.

4. *Confusion of a Possible Seasonal Trend, with the Results of Treatment.*—The inference that fluctuation in the amount of sputum is due to seasonal influences may only be justly drawn after examination of the treatment administered during the year, in order to ascertain to what extent the effects of treatment contribute to the results elucidated.

Results

(A) *The Entire Group of Forty-one Cases.*—The average daily deviation from the mean of the year during each month of the year is recorded in Fig. 1. From this graph it will be noted that during January the amount of expectoration was equal to the average for the year. A daily increase began in February, but in March and April this increase was more pronounced. From May to September the expectoration was below the average, reaching the minimum in July. A slight increase occurred in October, but in November and December the expectoration was below the average.

(B) *The Seasonal Change in Expectoration in Various Clinical Types of Case.*—The results as described under (a) above afford a valuable indication of the general trend, and it appears that February, March, and April constitute a danger period such as was previously shown to occur in glandular tuberculosis. But this method does not take into account the relative variations in individual cases, nor in different clinical categories.

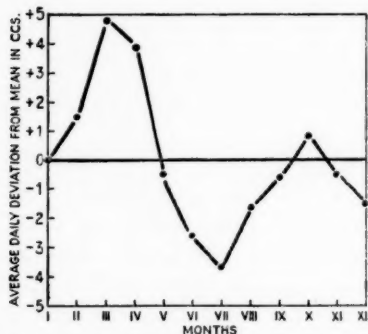


FIG. 1.—SEASONAL VARIATION IN THE VOLUME OF EXPECTORATION IN PULMONARY TUBERCULOSIS.

The variation is expressed as an average daily deviation from the mean for the year.

to August, 1933. Expectoration appeared for the first time eight months after admission to the sanatorium in February, 1933. In March it was slightly more copious. In April it disappeared, and was never noted again. Sputum in this patient was always scanty and never exceeded 4 c.c. per day.

The second curve in Fig. 2 relates to a patient (Case 8) who was the subject of a moderate degree of involvement with cavity formation, but no obvious bronchitis. The observation extended from February, 1934, to March, 1935, at which date a therapeutic pneumothorax was instituted and the observation for the discovery of seasonal change was necessarily concluded. There was a considerable increase in expectoration in April, 1934, and again in February and March, 1935. Throughout the whole

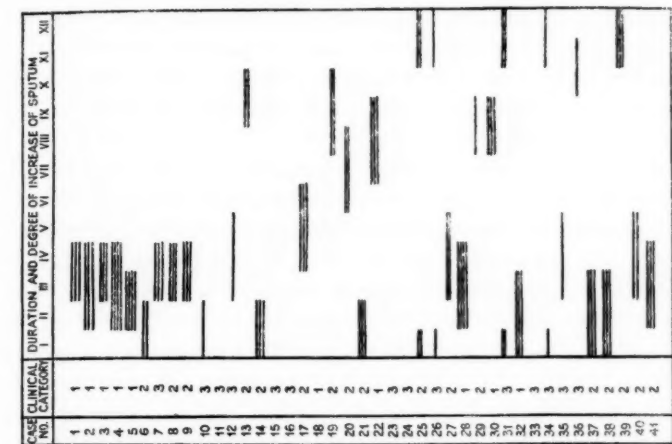


FIG. 3.—THE DEGREE OF SEASONAL CHANGE IN SPUTUM IN FORTY-ONE CASES OF PULMONARY TUBERCULOSIS.

For explanation of clinical categories and degrees of variation see text.

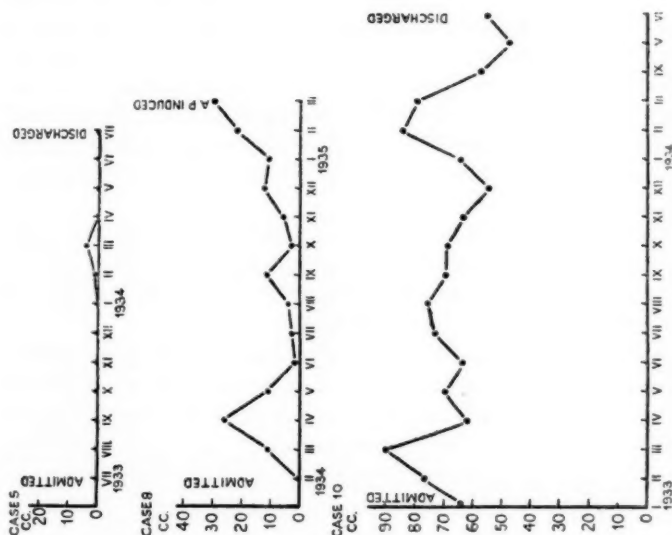


FIG. 2.—THREE ILLUSTRATIVE EXAMPLES OF SEASONAL VARIATION IN THE VOLUME OF SPUTUM IN PULMONARY TUBERCULOSIS.

These correspond to three clinical types described in the text.

period of observation the amount of expectoration was much greater than that noted in Case 5.

The third curve in Fig. 2 (Case 10) depicts the figures for a patient with advanced tuberculosis with cavity formation and gross bronchitis from January, 1933, to June, 1934. Two major fluctuations in sputum occurred in March, 1933, and in February and March, 1934, respectively. Here the average amount of expectoration was very much greater than in either of the preceding examples.

In considering the recorded trends in these three cases it was desirable to estimate which exhibited the most pronounced seasonal change. Despite appearances to the contrary, the seasonal variation was actually most marked in Case 5, in which there was no sputum at all except during the danger period. Moreover, the seasonal increase in expectoration in Case 8 was more pronounced than that in Case 10, since in the former it amounted to approximately an increase of 100 per cent. over the average for the rest of the year, whilst in the latter this increase only amounted to about 30 per cent.

With these considerations in view an attempt was made to record graphically the relative extent to which each of the forty-one cases exhibited or failed to exhibit a seasonal variation in the amount of expectoration, and to estimate such seasonal change as it occurred in the three groups of clinical cases corresponding to the illustrative examples which have been described. In Fig. 3 any substantial increase in the amount of sputum is recorded by a series of parallel lines corresponding to the time of year at which such increase was noted. The degree of change is shown by the number of lines in accordance with the following arbitrary definitions:

(a) *A very marked seasonal change* was stated to have been present when no sputum was recorded at any other time of year than that denoted by four lines (=====).

(b) *A marked seasonal change* was one in which the average daily volume of sputum during its most copious period was at least 100 per cent. greater than the corresponding figure for the rest of the year. This degree of variation was indicated by three lines (=====).

(c) *A moderate seasonal change* was one in which the average daily volume of sputum during the period indicated was between 50 and 100 per cent. greater than the corresponding figure for the rest of the year. This degree of variation was depicted by two lines (=====).

(d) *A slight seasonal change* was one in which the average daily volume of sputum during the period indicated represented an increase of between 30 and 50 per cent. as compared with the corresponding figure for the rest of the year. Such a change was denoted by a single line (=====).

(e) *No discoverable seasonal change* referred to any change less pronounced

than that described under (d) above. Such patients are represented by a blank in Fig. 3.

Fig. 3 shows that the increase observed in individual cases occurred most frequently from February to April, or during part of that time. This phenomenon was demonstrated in twenty-two out of forty-one cases. During the months of May to July fewer cases exhibited an increase in sputum than at any other time of year. Similarly, the corresponding numbers of cases which were the subjects of increased sputum during the periods August to October and November to January was slightly larger, but still less than one-third of the number of cases observed to exhibit increases in sputum during the danger period. In seven cases no change of any kind was recorded.

But the important part of Fig. 3 lies in the analysis of the degree of seasonal variation in relation to the clinical type of case. This has been elaborated in the following table:

TABLE I.—THE INCIDENCE OF SEASONAL VARIATION IN EXPECTORATION IN DIFFERENT CLINICAL TYPES OF CASE.

Type of Case.	Number of Cases.	Number of Cases in which the Seasonal Increase in Expectoratation during the Months of February, March and April was recorded as (a), (b), (c), (d).				
		(a) Very Marked.	(b) Marked.	(c) Moderate.	(d) Slight.	Total.
1	10	3	4	—	—	7
2	17	—	8	3	—	11
3	14	—	1	—	3	4

For definition of (a), (b), (c), (d) see text (p. 192).

Type of case:

1 = early pulmonary tuberculosis.

2 = pulmonary tuberculosis with cavitation.

3 = pulmonary tuberculosis with cavitation and gross bronchitis.

This table shows that 7 out of 10 early cases of pulmonary tuberculosis exhibited an increase in expectoration during the danger period, and that in each of these 7 instances seasonal increase was of the more pronounced types. Furthermore, out of 17 cases of pulmonary tuberculosis with cavitation, 11 exhibited the seasonal increase in sputum, but there was a tendency for the actual degree of variation to be less pronounced. Finally, out of 14 cases with cavitation and gross bronchitis, only 4 exhibited an increase of sputum during these months. Of these cases, 1 showed a marked seasonal trend, whilst 3 showed only the mildest recorded change.

It would seem, therefore, that this seasonal fluctuation is most definite in early cases of pulmonary tuberculosis. It was slightly less marked in patients whose lesions had become excavated, and least pronounced in those with marked bronchitis in addition.

(c) *Correlation of the Results with Treatment.*—The general statement made above that the sputum is commonly most copious from February to April, and more scanty from June to September, requires further examination to decide whether the results of treatment might have imitated or contributed to the change apart from seasonal influences. Since, by the selection of cases, collapse therapy does not enter into the question, consideration needs to be given to two factors only—namely, routine sanatorium treatment and gold therapy.

1. *The Effects of Routine Treatment.*—These forty-one cases were under treatment for at least one year, and it might therefore be argued that clinical improvement occurring during that time would detract from the significance of any trend which was stated to be due to other (*e.g.*, seasonal) causes. But since the observations began at all times of year with almost equal distribution, save for one month, it seemed improbable that this source of error would be serious. Actually the largest number of cases in which the observation began in any one month was 7 in the month of January, as against 3 or 4 for other months of the year. Any marked clinical improvement in this number of cases would have tended to flatten the subsequent spring-time rise in the expectoration, whereas in actual fact the reverse seems to have been the case.

Apart from this consideration, however, it was found that even after months of improvement the seasonal change described was noted to occur, and even in four cases to recur the following year. Reference to Fig. 2 shows that in Case 5 the seasonal change occurred after seven months' treatment, whilst in Cases 8 and 10 it was observed not only in the spring following admission to the sanatorium, but also a year later.

2. *The Effects of Gold Therapy.*—An apparent seasonal trend could be partially imitated by gold therapy if in this series of cases the sputum was frequently diminished by gold treatment during the summer and autumn. The collected data would consequently give relatively high readings during the winter and spring. The treatment records were therefore examined to ascertain if this was, in fact, what had taken place. The result of such an analysis, however, showed that gold treatment was in no way related to the seasonal change described. Briefly, the summary of such treatment may be stated as follows:

Only 8 of these 41 cases received gold therapy. In 2 cases (Nos. 16 and 18) no seasonal trend of any kind was determined. In 1 case (No. 20)

only 1.0 g. of solganal was administered, with no apparent clinical effect. In 3 cases (Nos. 17, 37 and 38) an increase in the sputum occurred despite the treatment, and in each coinciding with the danger period of the year. In 2 cases (Nos. 19 and 34) an increase in the sputum occurred shortly after treatment had stopped—*i.e.*, in the spring—but this change is not recorded in Fig. 3, since it was not of sufficient magnitude, and the main output of expectoration occurred at a different time of year. Hence it may be justifiably assumed that gold treatment has not led to phenomena attributed to seasonal change.

II.—SEASONAL VARIATION IN THE INCIDENCE OF HÆMOPTYSIS

In America it has been stated by Burns (1922) that hæmoptyses in pulmonary tuberculosis occur most frequently in June, and by Anders (1909) that they occur most frequently in December, January and February. The following analysis describes the seasonal incidence of hæmoptysis as recorded in Southfield Sanatorium Colony, Edinburgh, and in the Tuberculosis Department of the Royal Infirmary, Edinburgh:

Selection of Cases.—For the purpose of this investigation hæmoptysis was taken to mean the expectoration of fluid blood by a patient suffering from pulmonary tuberculosis in whom there was no associated cardiac lesion. No consideration was devoted to blood-streaked sputum. In each case the date of bleeding was recorded, and classified according to the time of year. In cases in which recurrent hæmoptyses were noted the initial bleeding only was taken into account. Nevertheless, in cases in which a period of six months intervened between consecutive hæmorrhages such recurrences were included as separate hæmoptyses. This device avoided the preponderance which would be allotted to any given time of year by counting each bleeding in cases with frequent hæmoptyses.

Results.—In this investigation 268 hæmoptyses were recorded in 245 patients. These hæmorrhages were divided into twelve groups according to the month of the year in which each occurred, and the monthly incidence is recorded in Fig. 4. It will be noted that there is apparently a slight increase in the frequency of hæmoptyses in March, but for the most part the distribution throughout the year is remarkably uniform.

The significance of the increased number of hæmoptyses in the month

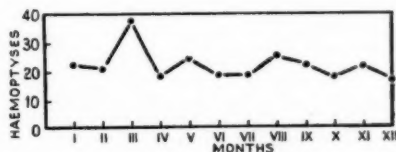


FIG. 4.—THE SEASONAL INCIDENCE OF 268 HÆMOPTYSES IN 245 CASES OF PULMONARY TUBERCULOSIS.

of March is doubtful. Whilst the fact of such an increase is suggestive, having regard to other seasonal phenomena in tuberculosis, it must be noted that no such tendency was noted in February and April, which months also constituted part of the danger period. It is therefore improbable that much significance can be attached to the results depicted in Fig. 4. Unfortunately it was not possible to separate early congestive hæmoptyses from those later hæmorrhagic accidents that occur during the erosion of vessels. Possibly the former would be more susceptible to seasonal influences, and the results more striking.

Summary and Conclusions

An analysis has been carried out of the daily sputum output in forty-one cases of pulmonary tuberculosis for at least one complete year. After reducing the available data to an annual basis, it was ascertained that there was a tendency for the sputum to be more copious during the months of February, March and April (or for part of that time) than at any other season of the year. This phenomenon was most clearly encountered in early cases of tuberculosis and slightly less so in cases with cavities. But in the grossly bronchitic cases the seasonal trend was less commonly demonstrated.

As far as could be ascertained the results were not distorted by the effects of treatment, but pointed to a true seasonal change comparable to that previously shown to occur in glandular tuberculosis. It thus appears that in pulmonary tuberculosis the softening of lesions takes place most commonly in the months of February, March, and April.

A definite seasonal trend has not been demonstrated in the incidence of hæmoptyses.

Acknowledgments

This statement is one of a series which the author submitted to the University of Edinburgh for the Degree of Doctor of Medicine. He is indebted to Dr. Fergus Hewat for permission to analyse the records of the Tuberculosis Department of the Royal Infirmary of Edinburgh in connection with the second portion of this paper.

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A REVIEW OF SEVENTY-SEVEN CONSECUTIVE CASES OF PULMONARY ABSCESS

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THE purpose of this paper is to discuss the clinical features of 84 consecutive cases of pulmonary abscess as they came under my own observation. I was asked to see some of the patients by medical colleagues, who themselves remained responsible for the treatment.

Though the features of all the cases were primarily those of lung abscess, 7 patients were sooner or later discovered to have an underlying malignant growth. The number of cases of non-malignant pulmonary abscess which is available for study therefore is 77. The malignant cases are of present interest only in so far as they indicate the frequency with which the differential diagnosis between these two conditions causes difficulty. It is at times impossible, except on the post-mortem table, to discover the malignant origin of lung cavitation, however shrewd the suspicion may be and whatever diagnostic aids are employed.

For the compilation of the statistics set out below available records do not in every case give all the information necessary, and the details in the various tables refer to the numbers concerning which the given information is available. The tables are largely self-explanatory. It will be noted that an attempt has been made to differentiate between putrid and non-putrid abscesses.

Incidence.—Of the 77 cases, 54 occurred in males, 23 in females.

TABLE I.—SEX INCIDENCE, BASED ON SEVENTY-SEVEN CASES

	<i>Putrid.</i>	<i>Non-Putrid.</i>	<i>Putridity not Stated.</i>	<i>Total.</i>
Males	32	16	6	54
Females	14	7	2	23

Tables II. and III. show the age distribution.

TABLE II.—AGE DISTRIBUTION (PUTRID ABSCESSES), BASED ON FORTY-SIX CASES

	0-10.	10-20.	20-30.	30-40.	40-50.	50-60.	Age not Stated.
Male	2	2	4	9	9	5	1
Female	0	2	4	3	4	0	1

TABLE III.—AGE DISTRIBUTION (NON-PUTRID ABSCESSES), BASED ON TWENTY-THREE CASES

	0-10.	10-20.	20-30.	30-40.	40-50.	50-60.	Over 60
Male	1	0	2	1	3	6	3
Female	0	2	2	2	0	0	1

It will be noted that 10 of the 23 non-putrid abscesses occurred in people over fifty years of age.

TABLE IV.—ANATOMICAL DISTRIBUTION, BASED ON SIXTY-SEVEN CASES

	Putrid.	Non-Putrid.	Putridity not Stated.	Total.
Right upper lobe	11	7	1	19
Right middle lobe	3	1	—	4
Right lower lobe	11	2	2	15
Left upper lobe	4	5	—	9
Left lower lobe	7	4	1	12
Juxta-scissural	1	1	—	2
Multiple	4	1	1	6

In the two instances of "juxta-scissural" abscess some radiological doubt existed as to whether the abscess cavity was situated in the interlobar fissure. On clinical grounds, however, the condition was regarded as one of lung abscess. Baumgartner¹ holds that most so-called interlobar empyemata are in reality lung abscesses, and he uses the term "juxta-scissural" to describe his conception of their pathology. I believe that true interlobar effusions are commoner than Baumgartner's views indicate, and I have excluded cases of interlobar empyema from this series.

Six patients are shown as having suffered from multiple abscesses. In 4 the distribution was bilateral. In 1 there were abscesses in two lobes on the same side, and in 1 there were multiple abscesses in a single lobe. In most of these patients the condition was advanced, and probably represented a stage at which an originally localised pneumonitis had become widespread.

Ætiology.—The causative factors are indicated in Table V.

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TABLE V.—ETIOLOGY, BASED ON SEVENTY-SEVEN CASES

<i>Cause.</i>	<i>Putrid.</i>	<i>Non-Putrid.</i>	<i>Putridity not Stated.</i>	<i>Total.</i>
Pneumonia and influenza	3	3	2	8
Measles	—	1	—	1
Following extraction of teeth	11	1	—	12
Following operation on tonsils	3	—	—	3
Following abdominal operation	4	2	1	7
Inhaled foreign body	1	—	—	1
In course of septicæmia	—	1	—	1
Puerperal	2	—	—	2
In course of chronic chest disease	7	6	—	13
Associated with bronchiectasis	2	—	—	2
"Unknown"	11	9	3	23
No record of cause	2	—	2	4
Total	46	23	8	77

There is a group of patients in whom the onset of a pulmonary abscess is by no means a bolt from the blue, but who have complained of cough and sputum for years. Such patients are exemplified by pensioners who were gassed or wounded in the chest during the Great War. In these chronic cases it is sometimes difficult or impossible to decide from the history just when the pulmonary abscess made its appearance.

Pre-existing disease is also a factor in some of those cases in which the onset of the abscess is ascribed to an abdominal operation. No doubt the surgical intervention in these circumstances does determine the appearance of the abscess, but proper care in case-taking will not infrequently elicit a history of chronic chest disease, when it would otherwise be all too easy to regard the operation as the sole ætiological factor.

It is, however, rather surprising to find how infrequently pulmonary abscess is associated with frank bronchiectasis.

A reference should be made to the largest single ætiological group in the table, that under the heading "Unknown." This comprises the cases in which no cause could be discovered on questioning. Possibly it should also include some or all of those in which the abscess was said to be a complication of pneumonia or influenza. Stern² has studied a series of putrid abscesses of "unknown" ætiology, and he has made out a case for assuming that a considerable number of these abscesses are caused by the aspiration of particulate matter from septic teeth during sleep.

Treatment.—No one line of treatment was followed as a routine. While there has been some variation in the methods of treatment adopted in

different clinics—in the readiness to apply surgical measures, for example—it will probably never be possible to evolve a standardised form of treatment applicable to all cases of pulmonary abscess. In the present series medical measures have included postural drainage as well as medicinal treatment. I have not practised bronchoscopic lavage of abscess cavities. Repeated bronchoscopic aspiration was used in some cases, but I have never been convinced that the benefit derived from this method compensated for the discomfort which it caused. It should be added that diagnostic bronchoscopy is practically a routine.

Operative treatment in general aimed at pneumonotomy in two stages. It is perhaps unnecessary at this date to emphasise the danger of artificial pneumothorax, a form of treatment which has probably been almost universally abandoned.

Of the 3 patients treated by combined surgical measures, in 1 drainage of right and left empyemata was carried out, and extra-pleural compression of the pulmonary abscess became necessary later. One had pneumonotomy followed by a local thoracoplasty, and the third had an artificial pneumothorax, phrenic evulsion, and later a four-rib thoracoplasty.

Mortality.—The over-all mortality for the series was 28·5 per cent. While the figures under some headings are small, several of them are instructive. Of the 31 patients who received medical treatment only, 4 died (13 per cent.). The mortality amongst those who underwent a two-stage pneumonotomy was 25 per cent. Three out of 5 patients recovered after simple evacuation of an associated empyema without direct attack on the lung abscess.

TABLE VI.—MORTALITY, BASED ON SEVENTY-SEVEN CASES

	<i>Putrid.</i>		<i>Non-Putrid.</i>		<i>Putridity not Stated.</i>		<i>Total.</i>	<i>Dead.</i>
	<i>Total.</i>	<i>Dead.</i>	<i>Total.</i>	<i>Dead.</i>	<i>Total.</i>	<i>Dead.</i>		
Medical only	12	4	12	0	4	0	28	4
Repeated bronchoscopic aspiration ..	3	0	0	0	0	0	3	0
Artificial pneumothorax	1	1	0	0	0	0	1	1
First stage pneumonotomy only ..	6	6	2	1	0	0	8	7
One-stage pneumonotomy	3	1	1	1	0	0	4	2
Two-stage pneumonotomy	15	2	6	3	3	1	24	6
Combined surgical measures	3	0	0	0	0	0	3	0
Aspiration of empyema	1	0	0	0	0	0	1	0
Drainage of empyema	1	0	2	2	1	0	4	2
Removal of foreign body	1	0	0	0	0	0	1	0
Total	46	14	23	7	8	1	77	22

Of the 7 patients who died after only the first stage of a pneumonotomy, 2 had bilateral abscesses. One had an associated subphrenic abscess after a perforated duodenal ulcer, and in 1 an unsuspected cerebral abscess ruptured while the operation was in progress. The 3 other patients were in poor condition and died within twenty-four hours of the first-stage operation.

While the mortality figures shown in Table VI. are worthy of study, they are not large enough to justify detailed dissection. Any attempt to use them for the purpose of contrasting the results of medical and surgical treatment with one another could only lead to erroneous conclusions. The series represents a group of cases in which, generally speaking, the principle of treatment was to employ medical measures so long as improvement occurred, and to resort to surgery when these medical measures proved inadequate. The figures can only properly be judged with this fact in mind, and as a composite whole.

In 2 of the putrid cases the method employed was a quite limited pneumonotomy, which did not open the actual abscess cavities. The results have been gratifying. Both patients are well (seven-year and two-year follow-up). The beneficial effect in these circumstances must be largely attributed to aeration or oxygenation of the putrid cavity, since drainage was indirect and probably only partial. In general, however, the results of such limited operations are disappointing. Drainage of the bronchi in the region of the abscess, rather than drainage of the cavity itself, leaves the patient liable to the prolonged discharge of offensive pus, and to recurrent attacks of pneumonitis.

I have no experience of a form of treatment, ultra-short-wave diathermy, which has recently found some advocates. Schliephake,³ in 1936, reported some striking results, but as far as the literature available to me indicates only Kate Schindling⁴ has published confirmatory figures.

My own limited experience of short-wave diathermy in cases of empyema and bronchiectasis has not been very impressive, but it is insufficient to justify an expression of considered opinion. Brugsch and Pratt,⁵ in a very recent paper, have cast doubt on the efficacy of short-wave diathermy in pulmonary abscess, and have levelled the criticism against Schliephake's figures that the remote results of treatment were not reported. Beaumont,⁶ speaking of empyema and lung abscess, says: "Short-wave diathermy undoubtedly can produce the warmth within and without. To go beyond this and suggest specific bactericidal action is not only unwise, but in the present state of our knowledge unjustifiable."

Late Results.—The present condition is known in 43 of the surviving patients.

The medical and surgical figures are not comparable and cannot be contrasted with one another.

In cases tabulated in categories (a), (b), (c), and (d), the result is satisfactory. There were 14 unsatisfactory results. Table VII. may be summarised as follows:

					<i>Medical.</i>	<i>Surgical.</i>	<i>Total.</i>
Satisfactory	..	..	..	..	11	18	29
Unsatisfactory	..	..	..	..	8	6	14
Total	..	..	..	..	19	24	43

Hæmoptysis is frequent in the convalescent stage in both medical and surgical cases. As in other lung conditions, it is unpredictable as to recurrence and severity. One patient still has occasional bleeding five years after the operation, though she is otherwise practically free from cough and sputum. Usually the hæmoptysis subsides, but I have known it to be fatal in one operative case after apparent cure, and in one treated medically.

TABLE VII.—LATE RESULTS, BASED ON FORTY-THREE CASES

	<i>Medical.</i>			<i>Surgical.</i>			<i>Total.</i>
	<i>Putrid.</i>	<i>Non- Putrid.</i>	<i>Putrid- ity not Stated.</i>	<i>Putrid.</i>	<i>Non- Putrid.</i>	<i>Putrid- ity not Stated.</i>	
(a) Cured	2	6	1	5	1	2	17
(b) Clinically cured, with residual bronchial fistula	—	—	—	4	—	—	4
(c) Clinically cured, but with re- sidual cavity	—	—	—	2	—	—	2
(d) Well, but with a little cough and sputum	1	1	—	3	1	—	6
(e) Suffer from periodic hæmoptysis	—	1	—	1	—	—	2
(f) Suffer from cough and sputum of significant amount	4	3	—	—	1	—	8
(g) Have a bronchial fistula as well as cough and sputum	—	—	—	3	1	—	4

Cases followed up for less than one year	..	..	..	..	3
Cases followed up for less than two years	..	..	..	..	10
Cases followed up for two years or more	..	..	..	..	8
Cases followed up for three years or more	..	..	..	..	9
Cases followed up for four years or more	..	..	..	..	1
Cases followed up for five years or more	..	..	..	..	8
Cases followed up for six years .. .. .	..	..	..	..	2
Cases followed up for seven years	..	..	..	..	2
					43

Comment.—In discussions on lung abscess a great point is usually made of the relative value of medical and surgical treatment. It is worth re-

peating that the present series offers no guidance on this question, which could only be settled with any finality by taking two large enough groups of consecutive cases and treating each group in turn exclusively by one of the two methods—a doubtfully justifiable experiment.

Two important papers which have a bearing on this point have recently been published by Neuhof and Touroff.^{7, 8} These authors hold that putrid lung abscess always occurs in the periphery of a lobe, and that pleural adhesions therefore form early. They perform a one-stage operation in the acute stage, which is arbitrarily fixed as being within six weeks of the development of the abscess. They used this method in 34 non-perforated cases without a single death, and in 11 perforated cases (which were complicated by a pyopneumothorax) with two deaths. All the patients who recovered were completely cured.

These are impressive figures and seem at first sight to indicate that the problem of the treatment of putrid lung abscess has been solved. There are, however, other points for consideration. In the first place, Neuhof and Touroff do not themselves advise operation in all cases. They distinguish between "mild" cases, in which medical treatment may be expected to be effective, and "grave" cases, of which the great majority require operation in the acute stage. Their 45 surgical patients covered a period during which the total number of those treated for putrid lung abscess at the Mount Sinai Hospital was 100.

In the second place, Neuhof and Touroff do not advocate operation for non-putrid lung abscess in the presence of one or more co-existing areas of broncho-pneumonia, nor when two or more abscesses are present.

Rives, Major, and Romano⁹ analysed 100 fatal cases of pulmonary abscess. Forty-six of these were classified as hopeless on admission. The most important causes of death were spreading pneumonitis and empyema. The chief factor in the determination of a fatal issue was the extent of the disease; 93 per cent. of the patients with bilateral abscesses died. Rather surprisingly, prolonged neglect was not found to be a major cause of death. Cutler and Gross¹⁰ point out that an abscess of many months' standing may heal as completely and as promptly as another of only two months' duration. Of my own surgically cured patients, 2 had had their abscesses for four and five months respectively, and in another X-ray records showed the abscess to have been certainly present for nine months, while the history pointed to its existence for two years before operation was undertaken. All 3 patients have been entirely free from cough and sputum for periods of fifteen months to seven years from the date of the operation.

Rives, Major, and Romano do not agree that the mortality would be lowered by treating all cases surgically. Surgery should be limited to

cases of single abscess after the acute stage is passed. In the presence of acute spreading pneumonitis, surgery, bronchoscopy and unskilful postural drainage aggravate the pulmonary condition and may cause heart failure. These authors point out that the remarkably low death-rates obtained by one favourite therapeutic method do not relate to series of cases which are comparable with theirs.

Without any doubt, Neuhof and Touroff have made out a strong case for early operation on putrid lung abscesses. Indeed, if further experience shows the operative risk to be as small and the ultimate results of early operation as uniformly satisfactory as their published figures indicate, their work seems to point inevitably to the conclusion that operation in the acute stage is the proper routine treatment of all putrid lung abscesses, and that time spent in trying to determine whether expectant treatment will result in improvement is time wasted. It is extremely difficult to divide cases as they present themselves into "mild" and "grave" from the point of view of their subsequent progress, or to forecast the future with sufficient certainty to be able to say that this or that case will be cured by non-operative measures.

The majority of attacks of acute appendicitis would subside under medical treatment, yet the surgeon operates in the early uncomplicated stage, when the operation itself adds little to the danger, because he thus enables himself with the greatest degree of certainty that is possible to control the prognosis in the case before him at the moment. The time factors in the evolution of acute appendicitis and pulmonary abscess differ a good deal, yet the same principle of treatment seems to apply, in the light of Neuhof and Touroff's experience. While it is true that numbers of patients with putrid abscesses recover medically (22 per cent. of known putrid abscesses in my own series), yet, faced with the individual case, of which the outcome is still uncertain, the surgeon must surely advise the measure which is most likely to determine a successful conclusion.

The same considerations apply, though perhaps with not quite the same force; in the case of the class of non-putrid lung abscess for which early operation has been found effective.

It must be emphasised that the early one-stage operation is, generally speaking, only applicable to single, accurately localised collections, and that the work of Neuhof and Touroff does not smooth out all the difficulties in the treatment of lung abscess—indeed, they themselves make no such claim for it.

Summary.—Seventy-seven consecutive cases of non-malignant lung abscess are analysed. There were 46 putrid and 23 non-putrid abscesses. In 8 there was no note as to putridity. The results are those of a routine

treatment which was primarily medical, surgery being employed when expectant treatment failed, or for complications such as empyema. The total mortality was 28.5 per cent. The late results of 43 cases are given.

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THE CHRONIC AMBULANT TUBERCULOUS

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THE majority of tuberculous patients sooner or later reach the stage of chronic ambulancy. Try as we may to collapse the lung with the open lesion, bring what pressure we dare on the still patent cavity, we cannot stem the flood of chronic cases which keep pouring upon us. A close examination of the history, the periods of relapses and other details, may convince us that at some time or other, in years gone by, energetic conservative or surgical measures might have produced an arrested case, and theoretically this may indeed be true. But the fact remains that theory fails in practice, with the result that our sputum-positive population preponderates.

As a physician in charge of an institution which is not immediately responsible to any one local authority, it has been my lot to receive many patients who have been in and out of sanatorium after sanatorium—"come-backers," as the Americans call them. These patients form the chronic ambulatory group and have very distinct characteristics. I speak from an intimate experience of over four thousand of them, mostly men above the age of thirty, and 75 per cent. over their fortieth year. Many have boasted that they know at least a dozen medical superintendents "personally," and I doubt not that the compliment is reciprocal. Their general bearing is remarkable. *They* are the veterans of the tuberculosis campaign, and not we who come to diagnose, prescribe and operate. Individually, they represent a community apart; collectively, they may be a menace to themselves and to the institution to which they are admitted, unless certain precautions are taken; and it is with these precautions that I am here particularly interested. As individuals they can teach us much. They can, for example, point to "years and years of disease" without anything more dramatic than an occasional hæmoptysis. They have in these days seen much of radiology and many can even describe the essential features of a radiogram. In one case recently, where the heart shadow was exceptionally narrow, I inadvertently placed the film the wrong way round in the viewing-box and commented discreetly on a large cavity in

the right upper zone; the patient informed me, however, that his cavity was on the left side. A speedy examination of the chest satisfied me that the patient was right, and I stood corrected and impressed. These chronic ambulanants are certainly in a class by themselves from every point of view. The majority accept the fact that the sanatorium is their one hope. They are safe from collapse therapy in any of its various forms; they are safe from the rigours of industrial life; they are safe in the hands of a benevolent local authority. The winter over, they settle down like hardened warriors to the spring and summer sun, accumulating a store of physical reserves sufficient to carry them through the following winter months. And so it goes on.

All this is no doubt sound enough from the standpoint of the chronic ambulant, but the local authority feels the repercussions in the stagnation of discharges. The "N.F.A." group (*i.e.*, no fixed abode) are a special thorn in the local authority flesh. For them there is no question of return to family life or industry, for neither exists to receive them. The result is that many sanatoria have from time to time an accumulation of these cases to constitute an administrative problem of the first magnitude. There must, in certain areas of England, be a group of men who have a deeper knowledge of the various institutions for the treatment of pulmonary tuberculosis than many tuberculosis physicians, for they have visited most hospitals and sanatoria in their own areas at some time or other during their tuberculous careers.

There is little need to describe the physical signs in the chronic ambulatory group. Tubercle bacilli are present in the sputum; the percussion and stethoscope findings are definite and almost always obvious. Radiological appearances are of interest merely on account of the variation which takes place between one case and another in the distribution of fibrosis and cavitation. The presence of bilateral disease and the abundance of adhesions makes collapse therapy a thing of the past. Prognosis becomes a matter of fibrotic predominance, temperature observation, and the onset of amyloid disease.

These patients have expectorated tubercle bacilli for years, and will almost certainly continue to do so so long as they live. Bronchitic complications are common; bronchiectatic manifestations are frequently seen, especially if sectional radiography is employed. Mostly, the pulse is between 80 and 90 a minute whilst the patient is resting, but over-exertion will produce profound disturbance in both pulse-rate and temperature. Weight can remain stationary for long periods, and even if slight losses are recorded from time to time a period of rest in bed will frequently restore the lost poundage. These patients know their limitations well, which is more

than can be said for many of the "early active" cases. One sometimes feels that the vital capacity in the average chronic ambulant is recorded in the mind of each patient to such an extent that the physical resources are tuned to the particular key in which each plays his part. They do not cover too much ground in any sphere of bodily activity; Nature will not allow of it.

Of course the chronic ambulant case is a charge on the State, and he knows it. He knows also that he is likely to be a *perpetual* charge on the State and local authority. Nothing has interested me more in this group than the skill with which they contrive to move from one institution to another with the utmost deference to the local authority responsible, always meaning to move back again, equally skilfully, to the institution in which they feel particularly at home. I have even known a patient who had been twice transferred by one local authority from the institution of his choice remove his lodgings to another district in London where he came under the control of another authority, and in this way was able to return to the place he loved best.

These chronic ambulants can baffle the best local authority administration which may be anxious to create vacancies for new patients. Psychologically the old-standing case of tubercle is happy so long as he is contented, but it is a mistake to think that he will put up with just anything. From his rich experience he can demand a table equal to the best he has ever known; he is particularly susceptible to the absence of routine examinations of his chest, which has probably been under the constant observation of a dozen or more distinguished physicians prior to his admission to his latest sanatorium. He even prides himself on the very slow progress of his disease, and may recount with satisfaction the story of how he refused "the operation he was advised to have ten years ago."

So long as pulmonary tuberculosis is a clinical disease, the chronic ambulant case will always be with us, but it is my opinion that he requires clinical and administrative action very different from the methods employed in most institutions today. He worries less about himself than others worry about him. They blame him for blocking sanatorium beds; if he is discharged, they blame him for being an active source for the spread of infection, and all are agreed that he may at any moment require as much care and attention as the most active case, irrespective of age. He dare not be lost sight of! For it must be remembered that the most urgent symptoms can be found in this type of case—spontaneous pneumothoraces, copious hæmoptyses, and even meningeal symptoms. No institution which is not in a position to deal with any or all of these complications can afford to accumulate large numbers of chronic ambulant cases. But I sincerely

believe that many of them have for long periods in their relapsing careers a utility value in the proper environment, and I have at Preston Hall seen some quite remarkable examples of this. I do not suggest that all can become full-time wage-earners or that it would be wise to offer them responsible administrative posts, even assuming that the native talent existed in them. But that they can perform useful functions and be relatively useful citizens is beyond all shadow of doubt, as the following case will prove.

J. W. A. was admitted as a patient to Preston Hall on March 14, 1932. Cost of maintenance was 45s. per week. In March, 1931, the patient had an hæmoptysis of undoubted origin and had been for three months in another sanatorium prior to coming to Preston Hall. On admission his weight was 9 st. 4 lb., and the temperature showed an evening rise during the first few weeks when he was at rest in bed. His general condition was poor and the physical signs were extensive, involving both sides of the chest with bilateral upper-zone cavitation. The sputum was positive. His condition slowly deteriorated, and on October 1, 1932, his weight had dropped to 8 st. 7 lb. During the winter of 1932 he made slight improvement and the temperature subsided. There was, however, no significant change in the pulmonary condition and the sputum remained positive. In January, 1933, he was allowed up for one or two hours, and by March of the same year he had "recovered" sufficiently to undertake the lightest of tasks in occupational therapy. In this work he showed marked aptitude, but he was also radiantly happy and contented. Although the appetite gradually improved and the temperature remained normal, the weight did not alter. Since 1933 there have been repeated radiological investigations made, and the two large apical cavities are still to be seen surrounded by thick fibrous walls. The sputum is still positive. This patient made such excellent progress in the department in which he was employed that he became in 1934 of real economic value to the industries of Preston Hall, and his local authority was given the benefit of a reduction in the charge for maintenance—from 45s. per week to 37s. 6d. There is no need to detail the events in the history of this case since 1934, except to say that, with the exception of two periods amounting in all to seven weeks, the patient has never been absent from work. He has done forty hours a week regularly, and has steadily progressed in economic value to such an extent that the charge to his local authority is now only 5s. per week. Weekly, at one time, we were afraid—despite the thermometer assurance and the general feelings of well-being of the patient himself—a crash would come, for the signs in the chest suggested that a pulmonary accident was inevitable. The patient still goes on, however; his condition does not vary; the physical signs remain. His cavities are still unclosed, and tubercle bacilli are still being expectorated in large numbers. His weight has not altered by more than one or two pounds in seven years, during which time he has earned over £1,000 in wages.

An exceptional case, no doubt, from the purely economic standpoint, but clinically this man represents that large class which are "blocking"

sanatorium beds, which are massively infective, and which require, not major or even minor surgical intervention, but simply a practical scheme which will enable them to remain under medical supervision in a hygienic environment and at a reduced cost to the local authority. This patient (J. W. A.) is *not* blocking a sanatorium bed, for he is living in the Village Settlement; the massive infection of which he is no doubt capable in certain London factories has been reduced to a minimum in the open spaces in which he is now working, and he is costing his local authority less than £13 a year.

Such examples of complete rehabilitation in relatively advanced cases are not uncommon under the present methods adopted by Village Settlements, and in March, 1933,* I published an account of the working capacity of the consumptive which elaborated this very theme. There are, however, a majority of patients in the same chronic ambulant group who can never, by reason of technical inefficiency, attain to the ideal of self-sufficiency as exemplified in this case. But even for those who are less competent it is possible to make reductions in maintenance charges so long as the requisite occupational and industrial machinery is available to make reductions possible. At the time of writing we have no less than thirty patients under treatment at Preston Hall, and for whom the respective local authorities are paying less than 20s. per week. These men earn varying amounts, but never less than 5s. per week. The selection of these patients for reduction in maintenance charges is a delicate matter and belongs to the technique of Village Settlement administration. In one group in particular we have an outstanding success—the post-operative case.

Modern surgical methods require long periods of convalescence following operation, and the increasing number of patients in sanatoria is yet another factor leading to the "blocking" of beds. But from the point of view of future work I regard the post-operative case as in much the same category as the chronic ambulant case, even if the sputum is negative, for my measure of comparison is the ability of the patient to return to ordinary industrial life and to the hurly-burly of open competition. I have not yet satisfied myself that the majority of post-operative cases are capable of this. An opening must be found for them which will not involve the responsible financial authority in a heavy continuous outlay over a period of years. And when I say "financial authority," I do not mean the Public Health Committee only of the local authority, for the obligation of that committee continues only whilst the patient is under residential treatment. I have in mind the burden which may be placed on the Public Assistance Committee

* "The Working Capacity of the Consumptive." *Brit. Med. Journ.*, March, 1933.

or on National Health Insurance funds if the patient is discharged from the sanatorium. It is a fundamental error to believe that if the patient is discharged from the sanatorium the financial responsibility of the local authority is necessarily at an end. In a large proportion of discharged patients the financial responsibility is merely transferred from the Public Health Committee to the Public Assistance Committee of the same local authority, unless, of course, the patient is fit to resume employment, which is rarely the case in the type we are considering here.

At Preston Hall we have endeavoured to make our contribution to the difficulties of the post-operative case, just as we have done for the chronic ambulant tuberculous. We have cases of thoracoplasty, some with and some without tubercle bacilli in the sputum, working as joiners, printers, and even as hospital orderlies, each man doing the job of work which in our opinion he is most competent to undertake. In the service of nursing especially we have introduced a scheme for the training of suitable patients—a scheme which has relieved us of much anxiety caused by the prevailing shortage of nurses. One of the most promising of our nursing orderlies in the operating theatre at Preston Hall was himself a patient who has had a three-stage thoracoplasty performed with conspicuous success. At the present moment we have nineteen ex-patients on the staff as domestic and nursing orderlies at Preston Hall, and many of these are no charge whatever to their local authorities.

To return all these men who are either partially or completely self-supporting to the areas in which they were formerly resident would mean a considerable additional expenditure of public funds, especially Public Assistance funds, and we feel we are justified in the interests of the local authority, in the interests of the institution, and above all in the interests of the patient himself, in offering every opportunity for residence and wage-earning under the very conditions which experience has proved to be most suitable for successful treatment.

Nowadays we have little difficulty in diagnosing pulmonary tuberculosis, especially in its grosser forms. In active treatment also we have innumerable alternatives to offer from rest in bed to any one of the major surgical procedures in vogue. But, unless the sputum is rendered indubitably negative, and unless the element of fibrosis supervenes speedily in the active lesion, there is no real alternative to the continuation of life under the sheltered conditions which only the sanatorium and Village Settlement can offer; otherwise relapse is too frequent and sure.

The inadequacy of our care and after-care methods have been criticised by the most ardent phthisiologists in all countries, and was proclaimed by Philip himself at the beginning of the present century. We

have seen Papworth rise and bring in its train Wrenbury Hall, Barrowmore Hall, Preston Hall, and a few other institutions to prove the justification of the method. We give lip-service and admire. We are apparently not yet satisfied that economic rehabilitation, even in one or other of the modified forms I have attempted to describe here, is the surest and most certain road to prolonging the life of the consumptive.

MEETINGS OF SOCIETIES

NATIONAL ASSOCIATION FOR THE PREVENTION
OF TUBERCULOSIS

THE twenty-fifth annual conference of the association was held in Belfast from June 29 to July 1, with the Marchioness of Titchfield, the president, in the chair. On the morning of June 29 the first of two discussions dealing with the "Problems of Organisation and Local Administration of Tuberculosis Schemes" was opened by Alderman E. H. Rickards, J.P. Dealing with general administration, he divided the administration of a tuberculosis scheme into four sections.

1. *Discovery and Diagnosis.*—The early stages of the disease were often undetected owing to the difficulty of persuading some people to submit to examination, and owing to the lack of suitable propaganda concerning existing facilities.

2. *Treatment.*—Administrative difficulties here centred around the insufficient accommodation to meet the long waiting lists of some authorities.

3. *Isolation and Prevention.*—The use of shelters and separate sleeping accommodation, education in hygiene, and rehousing schemes had all proved successful measures in combating the disease.

4. *Care and After-care of the Patient and his Family.*—The funds of care committees could not cover every type of assistance necessary. The greatest difficulty was met in the case of the young bread-winner discharged from sanatorium as fit for "light work," because light work was almost unobtainable. So far no serious effort had been made to find suitable employment for this type of patient, and the speaker suggested that workshops run in connection with sanatoria should be established. Discharged patients could then be profitably employed for regulated hours.

Dr. Andrew Trimble said that any scheme should be concerned both with the care and cure of the patient and with the prevention of a further spread of the disease to others. The decline in mortality was due more to the limitation of infection than to the cure of those affected by the disease. He sketched the development and progress of anti-tuberculosis measures in Belfast (where the death-rate had dropped by 67 per cent. from 1914 to 1938), and put in a plea for a periodic review of any tuberculosis scheme.

He suggested certain lines for further investigations, such as the study of the individual as a social unit, the cultivation of the health habit, and the training of school teachers in recognising suspicious signs of oncoming disease.

Dr. W. L. Yell regarded the tuberculosis dispensary as the central factor in all schemes. Hence the choice of a tuberculosis officer and nurse were of prime importance. He maintained that patients with early pulmonary, bone or joint tuberculosis and those in the advanced stage of pulmonary disease should be given prior claim to institutional treatment. The intermediate group were best catered for by the colony system, which fully deserved more generous subsidy. Dr. Yell then referred to the success of the small maternity unit at one of the Essex sanatoria to which patients are admitted six weeks before term and retained for three to six months after delivery. This, it was hoped, would banish many of the dangers attached to parturition in tuberculous women.

In the afternoon Dr. Peter Edwards opened the second discussion, dealing with arrangements for "Treatment by Artificial Pneumothorax."

Before an artificial pneumothorax was induced adequate facilities for carrying on the treatment should be ensured. These facilities he divided into "essential" and "desirable." The former included an experienced physician, a thoracic surgeon, an X-ray equipment for screening and taking pictures, and a suction apparatus for trocar and cannula. The "desirable" facilities included a rapid gas-replacement apparatus, an operating theatre for internal pneumolysis and phrenicectomy, and a quick method for sterilising needles in bulk.

Dr. B. R. Clarke thought that about 50 per cent. of all patients with open pulmonary tuberculosis required a pneumothorax. The induction was often a matter of urgency, and the lengthy wait for accommodation that was often encountered was deplorable. He emphasised the need for experience in spacing refills and preferred frequent small refills controlled by screening. Since the main object of a pneumothorax was to secure a lasting cure, the mental and physical reaction of the patient to the treatment should be constantly watched.

Dr. Brandon O'Brien considered the control of carriers to be the most important point in the prevention of tuberculosis, and this could be effected only by early diagnosis and adequate treatment. Artificial pneumothorax was not a substitute for sanatorium treatment, and he was opposed to inducing a pneumothorax without a preliminary period of observation.

In the evening discussion Dr. George Day said that tuberculosis officers with charge of pneumothorax patients should be provided with facilities for screening and radiography. This was not universal at present, with

the result that the lung was often either excessively or inadequately collapsed.

On the second day, with Sir Percival Horton-Smith Hartley in the chair, Dr. George Jessel, opening a discussion on "Tuberculosis in the Adolescent," said that the adolescent and young adult population had failed to participate in the continuous decline in the tuberculosis death-rate from 1901 to 1909, but that from 1933 onwards a steady fall had been noticed. After mentioning possible predisposing factors, such as shortage of food, fatigue, work and worry, he concluded that, apart from shortage of food, which the Registrar-General thought significant in explaining certain periods of arrested fall, no single factor could be regarded as responsible. Regarding treatment, the outlook had become more favourable, provided that it was applied early. Rest was the most important item, and artificial pneumothorax was useful in suitable cases. The examination of contacts should be compulsory and universal. One examination was not enough; they should be kept under observation for at least five years.

Dr. F. S. Hawkins cited the figures for Wales to show that the highest incidence of the disease is in the adolescent age-group. To account for this he invoked poor housing and poor food, the anxiety of finding a job, and the struggle to retain it. Certain symptoms such as a constant succession of colds, aphonia, lassitude, a failure to gain weight, and amenorrhœa should be regarded as danger signals. Treatment should be prompt and prognosis guarded, especially in young women. An annual radiographic examination of all persons between fourteen and twenty-one was desirable to secure proper prevention of the disease.

Dr. D. S. Price said that primary infection in childhood should not be regarded necessarily as benign, for it might progress to more serious manifestations. There were now more tuberculin-negative adolescents in the community than thirty years ago, and as a result more people were becoming infected for the first time relatively late in life. In Eire, for example, only 11 per cent. of healthy girls of fourteen in the country gave a positive reaction. She thought there was a connection between this late primary infection and the high death-rate in the fifteen to twenty-five age-group. She thought that more consideration should be given to the negative reactor.

Mr. A. R. Foster, headmaster of the Belfast Royal Academy, attacked the present-day system of education as fostering the spirit of mental cruelty. He illustrated his points by recounting a day in the life of an average pupil aged sixteen, compelled by his teachers during the day and his parents in the evening to expend a sum total of physical energy that would make the day's work of a coal-heaver "look like a pleasant afternoon in the

garden." He preferred quality rather than quantity in academic learning, and he thought that these deficiencies in our educational system were predisposing factors to tuberculosis.

Alderman P. Astins, J.P., drew attention to numerous gaps in the legislative framework and the need for amendments to make local authorities responsible for many social activities now only permissive. He laid particular emphasis on the need for adequate rehabilitation of a patient when he left sanatorium, suggesting that the State could profitably reserve a proportion of its lighter jobs for such people, as it did already for disabled ex-Service men.

Dr. W. M. MacPhail described the occupational training at Burrow Hill Sanatorium Colony. He said that about a third of the patients stayed at the colony the full length of the time. These patients had little difficulty in finding suitable employment in after life. Dr. Lloyd Rusby drew attention to the distinction between the tuberculous and the catarrhal type in a contact community. Dr. Banský described the modern technique of photographing the fluorescent-screen image. This had a bearing on mass radiography, for a permanent record could be obtained for $\frac{1}{2}$ d. a film.

At the afternoon session Dr. J. B. McDougall opened a discussion on "Architectural Problems in Connection with Tuberculosis Institutions." The medical superintendent was generally satisfied if administration was made easy. The patient should be encouraged by social and recreative amenities to look upon the institution as his temporary home. To the ratepayer the main interest was the cost. He held little brief for the present tendency to erect sanatoria at enormous expense. To illustrate his point he cited the recently constructed hostel at Preston Hall, which cost less than £200 a bed.

Dr. B. Lubetkin (whose paper was read in his absence) discussed the use of modern materials and constructive methods in the design of tuberculosis institutions. Light and air were essential, and he favoured cross-ventilation throughout. He thought that administrative and clerical services should be centralised, and the patients confined to the ground floor. He condemned the use of radiators as heating by convection, preferring the radiant type of ceiling heating with steel hot-water pipes.

Dr. Blyth Brooks said that a tuberculosis dispensary should be constructed to inspire confidence and create a friendly and homely atmosphere. He outlined the details of lay-out, illustrating with a plan of the Finsbury Health Centre. Dr. E. K. Pritchard, with experience of the new health services at Southwark, said that he was not in favour of conditioned ventilation, as it required closed windows.

TUBERCULOSIS ASSOCIATION

A meeting of the Association was held in London on Friday, May 19, the President, Dr. G. T. Hebert, taking the chair. Dr. J. G. Scadding (Hammersmith) read the first of two papers on "The Diagnosis of Pulmonary Tuberculosis without Bacteriological Confirmation."

Two aspects of this subject should be considered, that of the laboratory worker who had to assess the significance of "negative sputum," and of the clinician who had to determine which types of pulmonary tuberculosis it might accompany. The speaker mentioned the routine methods of detecting the bacilli in sputum; in a doubtful case his own practice was to have repeated direct examinations after concentration, and finally animal inoculation. Gastric lavage in infants was useful and faeces examination in adults. The bacilli might be absent from sputum in two types of pulmonary tuberculosis. It occurred with early active lesions, before caseation and eruption into bronchi. A second group comprised examples of chronic quiescent disease, with fibrosis or pleural thickening. Here active symptoms arose from small areas of fresh but as yet closed disease, or more commonly from secondary infection. Negative sputum which was purulent was less likely to be tuberculous than mucoid or frothy mucopurulent sputum.

Bronchial carcinoma could resemble pulmonary tuberculosis in symptoms and radiologically, especially when cavitation was a feature, or where there appeared to be mottled infiltration in the affected lobe, due either to small septic foci beyond an obstruction or lymphatic infiltration with tumour cells. Bronchiectasis and lung abscesses rarely caused difficulty, but the former might occur in arrested tuberculosis. Actinomycosis and blastomycosis sooner or later gave distinctive features. Syphilis of the lung produced bronchial stenosis after gummatous infiltration, or an interstitial pneumonia. Aortitis was probably always associated. Besnier's and Boeck's sarcoids led to the appearance in the lung of a coarse miliary mottling, often with grossly enlarged broncho-pulmonary glands. Other clinical features such as generalised lymphadenopathy, enlarged spleen or liver, chronic iridocyclitis, X-ray changes in bones of hands and feet, and the skin eruption might or might not be present. Often the tuberculin test was negative, whilst the benign course might eventually exclude tuberculosis.

Atypical and chronic pneumonias might cause difficulty. The speaker defined "pneumonia" as an inflammation of the lung characterised predominantly by alveolar exudation. Resolution of acute pneumococcal

pneumonias was sometimes delayed even ten or twelve weeks, and yet could be complete. Benign circumscribed pneumonia ("pneumonitis") comprised small areas of consolidation accompanying catarrhal affections, and was probably a localised aspiration pneumonia. Its onset might suggest pulmonary tuberculosis, but catarrhal symptoms predominated, and resolution was usually rapid. Chronic pneumonias had a prolonged course, possibly ending in fibrosis or suppuration with cough, sputum, wasting, and clubbing. Atypical pneumonias in scattered foci ("chronic diffuse bronchopneumonia") showed varying stages in different foci: early consolidation, resolution, fibrosis, or suppuration.

Dr. G. Ivor Davies (Kelling Sanatorium) followed and dealt with administrative difficulties of the subject, particularly those arising from erroneous notification. Many T.B. minus cases who recovered had never had the disease. Denotification at present was difficult, even after the proved non-existence of a tuberculous lesion. He mentioned an example where one positive in fifty negative sputa was sufficient for the diagnosis (afterwards proved mistaken), and he pleaded that one positive was insufficient for this purpose. He concluded with a short review of the advantages of preventoria for these patients, mention of the position of army pensioners, and a short survey of his own figures for T.B. negative cases seen at his dispensary.

The President, opening the discussion, quoted Robert Hutchinson's famous aphorism on Faith, Hope, and Charity, of which Faith (diagnosis) was really the greatest. It had perhaps been complicated as well as helped by the coming of X-rays. The single positive sputum might be due to many causes—*e.g.*, from tap-water. It was important not to notify unnecessarily, and a rapid clearing of shadows might exclude tuberculosis.

Dr. Gregory Kayne (Middlesex) spoke of gastric lavage. Its use in adults had been started at Clare Hall in 1936. Of 114 patients (163 lavages) 35 per cent. had been positive (culture and guinea-pig); of 55 patients with a negative sputum or none, 17 produced positive stomach contents; of 38 who were negative, 50 per cent. subsequently proved tuberculous, 50 per cent. were not.

Dr. W. C. Fowler (Pinewood) advocated a Ministry of Health review of notification. Dr. G. Jessel (Lancashire) thought it was wrong to wait until sputum became positive before making a diagnosis. Mr. J. E. H. Roberts (London), in congratulating Dr. Scadding, thought he had chosen cases difficult to an expert physician; many more would be difficult to those who were not such. Hæmoptysis could be misleading, and he advocated a wider use of bronchoscopy.

Dr. A. Niven Robertson (Derbyshire) suggested that the benefits of

treatment should be extended to all T.B. negative cases, as 20 per cent. became positive.

Dr. N. Tattersall (Leeds) pointed out that pleurisy with effusion is tuberculous, unless proved to the contrary, and in his view it should always be notified.

Dr. Scadding, in replying, agreed that more attention might be paid to history. He agreed with Mr. Roberts as regards bronchoscopy. Pleurisy with effusion should be regarded as tuberculous. Dr. Davies thought that Dr. Fowler's suggestion would complicate statistics of the first year of notification. He did not think one should wait for a positive sputum, but notify on two out of three criteria. Pleural effusion was usually to be regarded as tuberculous.

In the evening session Dr. T. W. Davies (Swansea) gave a paper on "Silicosis in Slate Quarry Miners." The story of occupational mortality in Wales was largely writ in stone. Dr. Davies defined the word "slate" as generally any kind of rock that could be split into sheets—strictly as rock which was once finely grained sediment like clay, or some kind of volcanic dust which had acquired cleavage properties due to heat and pressure whilst under the earth's surface. Slate-quarrying in Wales was found in Caernarvon, Merionethshire, Montgomeryshire, Denbighshire and Pembrokeshire, mainly in the first two. It was done in open quarries or underground workings. Mining was necessary where the strata inclined at low angles, as at Blaenau-Ffestiniog. The mine consisted in a series of cavities in a mountain with chambers up to 120 feet long, 40 feet wide, and 100 feet high. The quarrying population of 2,000 in Ffestiniog might be divided into: (a) underground workers—rockmen, miners, labourers; (b) workers in above-ground slate-mills—slate splitters, slate dressers. Underground, clouds of dust resulted from rock drills, ventilation was poor, and masks (where provided) reluctantly used. The death-rate from respiratory disease and pulmonary tuberculosis was high in the area, and the rate from tuberculosis among higher age groups was also excessive. Dr. Davies then went on to describe investigations done at a new clinic at Blaenau-Ffestiniog on 117 cases referred there between January, 1936, and December, 1937. Many of the quarrymen had previously been in the coal industry also, so that a division had to be made between those exposed to coal risk and quarry risk, and those with quarry risk only; 15.6 per cent. of the total were T.B. positive, 12.5 per cent. of the silicotic cases, which comprised 62.3 per cent. of all cases seen.

Dyspnoea was the chief symptom. Cough—so common in the mines as to be disregarded—sputum, loss of weight (more so with added infection), hæmoptysis (rare), and pain in the chest also occurred. Abnormal signs

were variable, sometimes absent. X-rays showed the three stages of silicosis, but confluent shadows in Stage 3, instead of being hilar or subapical, were often basal, and round nodular shadows occupied the mediastinum or prehilal regions, showing a dappled appearance, with apparent calcification at the edge of the mass.

The speaker then mentioned one case which had come to autopsy. There was advanced tuberculo-silicosis in the lower part of the left upper lobe. The glands were greyish and very hard. Calcification in glands might be due either to the added tuberculous infection or to degeneration and lime-salt deposit following silicotic infiltration. The work of Sweany and of Kettle supported the first theory, but these changes were not seen in silicotics from coal-fields near Swansea. On the other hand, lime-salts might be deposited in glands affected by fibrosis due to silicosis followed later by hyalinisation.

The President thought that occupational risk in quarry miners ought to be investigated. He had seen the "shell-like" appearance mentioned in the mediastinal glands of South African miners with infected silicosis. He enquired regarding evidence of emphysema in Dr. Davies' cases.

Dr. D. A. Powell (Cardiff) said that fibrosis appeared to be both a cure and a disease, the latter in the quarrymen. There was certainly a case for a Home Office investigation. Gastric carcinoma was very frequent in quarry workers, and conceivably there might be ingestion of silica through the stomach mucosa. Dr. E. L. Middleton (Home Office) drew attention to the Wade Report of a few years ago, which dealt with the slate-quarry industry in Caernarvonshire, where there was a high phthisis death-rate. It showed a high incidence of disease in quarry miners and millmen—more in the latter, who work in the open. Further investigation must be statistical. Differences in silica content of dusts complicated diagnosis. He agreed that there was a further ground for investigation. Dr. H. D. Chalke agreed that the high death-rate in old age in the district was due to the slate industry. Possibly the higher death-rate in the open than underground might be explained by the less robust men gravitating to the sheds. Dr. N. Tattersall (Leeds) was impressed by the view that the process in the glands might be one of degeneration. Dr. S. Roodhouse Gloyne (London Chest Hospital) said that dust accumulating in the lungs sooner or later caused X-ray shadows; possibly glands could become opaque even from absorption of a non-siliceous dust. He was unconvinced that calcium could be present without tuberculous infection. Dr. M. Davidson (London) mentioned a case which followed inhalation of aluminium dust.

Dr. T. W. Davies, replying, said that there was a good deal of emphysema in the condition. Silica absorption was known to occur through the stomach.

REVIEWS OF NEW BOOKS

Tuberculosis and Social Conditions in England, with Special Reference to Young Adults. By P. D'ARCY HART and G. PAYLING WRIGHT. National Association for the Prevention of Tuberculosis, London. Pp. vii+165. Price 3s.

Although the general death-rate from pulmonary tuberculosis has been declining steadily, that for young men and women aged fifteen to twenty-four has remained almost unchanged during the greater part of the present century. This arrested decline has been particularly evident among young women, whose pulmonary tuberculosis death-rate per 100,000 fell from 276 to 112 in the thirty years between 1871 and 1901, but showed practically no further change in the next thirty years, being 107 in 1911-13 and again in 1931-33. Moreover, at the present time nearly half the deaths from all diseases among young women are actually due to pulmonary tuberculosis. This is one of the most pressing health problems, and, as pointed out in the preface to this report by Sir Arthur MacNalty, has been a source of anxiety to tuberculosis workers for some time.

In the present report the causes of this situation are sought by a statistical investigation of those social conditions which have long been known to be closely connected with the disease. Taking the country as a whole, the authors demonstrate a close correspondence between the course of the standard of living as judged mainly by changes in average real earnings of the working class during the past ninety years and the course of pulmonary tuberculosis mortality. What is particularly important is that the relationship is closer for young adults than for any other age. For young women the correspondence of the curves for real earnings and tuberculosis mortality is so close—including, as it does, a check to the increase in real earnings at about the same time in the beginning of the century as the commencement of the setback to the fall in tuberculosis mortality—that cause and effect are suggested. The authors therefore believe that one factor in producing the retardation in the decline in pulmonary tuberculosis death-rate among young adults is a contemporaneous slowing in the improvement of the national standard of living. To explain the selective action of this factor they suggest that at the formative period of adolescence young men and women, more especially the latter, are particularly sensitive to social conditions as regards their development of tuberculosis. They believe this sensitiveness to social conditions to be due possibly to the stress and strain arising from the environment of industry, together with the biological changes occurring during adolescence.

Two further social changes are found to have taken place at the same time as the setback to the improvement in pulmonary tuberculosis in young adults, and are thought to have been contributory factors. One is the

rather prolonged check to the reduction in overcrowding. Thus the percentage of persons living more than two per room was actually greater at the 1921 census than in 1911 or in 1901, though it has resumed its reduction subsequently. The other important social change is the marked rise at the beginning of the century in the employment of young women, particularly in industrial occupations which to some extent have replaced domestic service. This increase in industrial employment, with its accompanying strain and fatigue, and with its tendency to bring young women more into contact with large numbers of persons, might be expected to increase their liability to tuberculosis.

Taking the country in its various divisions, the authors find that the slowing in the improvement in pulmonary tuberculosis among young adults is very unevenly distributed. It has been more severe in the larger urban areas than in rural districts, and in those county boroughs where poverty, particularly housing inadequacy, has been most marked. In a large group of especially ill-housed boroughs the tuberculosis mortality of young women actually rose between 1911 and 1933. A special chapter is devoted to considering the London boroughs. Here there is evidence suggesting that in addition to housing the nutritional factor of poverty has some influence upon tuberculosis mortality.

It seems, therefore, that the unsatisfactory course of pulmonary tuberculosis among young men and women during the greater part of the present century is due to a group of factors. Unsatisfactory trends in national standards of living and the rapid industrialisation of young women appear to have played important rôles, while bad local social conditions, in particular bad housing, have increased the effect in certain localities. If these explanations be correct, then it is clear that the money that has been spent in the past on social legislation is money well spent. It is equally clear that there is still much to be done in this field if the health of such an important part of the community is to be safeguarded adequately in the future.

The Statistics of Pulmonary Tuberculosis in Denmark, 1925-1934. By MARIE LINDHARDT. Ejnar Munksgaard, Acta Tuberculosea Scandinavica, Supplementum 111. Copenhagen, 1939.

This volume consists of an attractive presentation of a careful series of analyses of the statistics relating to pulmonary tuberculosis for Denmark between 1925 and 1934. The total morbidity of the disease in that period was 11.1 per 10,000, the mortality 5.7, representing 5.2 per cent. of all deaths. During the period the morbidity decreased by 15 per cent. and the mortality by 19 per cent. Both morbidity and mortality are highest among females, who, in contrast to this country, have shown a heavier decrease than males, especially in the age group fifteen to twenty-four. For both males and females, however, morbidity is higher in the group twenty to twenty-four years than at other ages, and for the whole country about half the deaths at that age were due to the disease. Occupational factors show their influence on the incidence of the disease in the unfavourable figures for those employed in the hotel and restaurant business and as

seamen. Shop assistants and subordinate office staffs are more affected than the superiors in the same main groups. A high morbidity of the disease in young physicians and medical students is disclosed, though it appears that in spite of this their mortality is almost exactly the same as the average for all breadwinners.

The General Tissue and Humoral Response to an Avirulent Tubercle Bacillus. By SOL ROY ROSENTHAL. Illinois Medical and Dental Monographs, Vol. II, No. 2. Urbana: University of Illinois Press, 1938. Pp. 184. Price \$2.50.

This is a study on the tissue reactions elicited in guinea-pigs after BCG-administration by various routes (intravenous, intradermal, oral). Not only the histological changes (appearing within ten minutes to fourteen months after administration), but also the colony and bacillary morphology (the "life-cycle" of the bacillus), and the reactions elicited by fractions of the bacillus, are described in detail. In addition to focal changes, general reactions of the reticulo-endothelial system are being demonstrated for which "submicroscopic" forms—i.e., those that may evade detection because of their similar staining properties to the tissues—are held responsible. A detailed examination of the blood picture showed a parallelism of the humoral and tissue reaction to the invasion with the avirulent bacillus. The author again proves that there is no uniform sequence of tissue reactions, but that the proliferative and exudative character of a nodule depends upon the number of bacilli and the structure of the organ involved.

Dissociation of Tubercle Bacilli. By J. FRIMODT-MÖLLER, London and Copenhagen: H. K. Lewis and Co., Ltd., 1939. Pp. 256. Price 10s.

Ever since Petroff reported that he had been able to cultivate a smooth virulent bacillus from a rough avirulent BCG-culture, "dissociation" of tubercle bacillus was widely debated. Its possibility was generally recognised for the avian bacillus, but denied, at least by some authors, in the case of the human and bovine types. A comprehensive critical representation of the subject as the present one is therefore welcome, particularly as it is substantiated by the vast personal experience of the author. It appears that smoothly growing so-called "dysgonic" strains of the human type displayed a dissociation into rough "eugonic" colonies, but that there was no alteration in virulence. A similar phenomenon was seen in bovine strains, but in some of them there was alteration in virulence connected with the variation in colony morphology; but even there alteration in virulence was unstable, the attenuated eugonic cultures regaining their original high virulence to rabbits and guinea-pigs merely by a single passage through either animal. It is therefore doubtful whether this phenomenon deserves the name of "dissociation." Two of the eugonic bovine dissociants, however, formed a group of their own with characteristics very similar to those of BCG. On the strength of these results the author is inclined to believe in a—practically minimal—possibility of BCG reverting into virulent bovine forms.

Tuberculin Tests in Cattle. By J. B. BUXTON and R. E. GLOVER. H.M. Stationery Office. 1s. 6d. net.

The value of the intradermal tuberculin test in detecting tuberculous infection in cattle has now been well established, and its importance has demanded more detailed investigation into certain anomalies which arise in the interpretations of the results and also has stimulated the search for substances more suitable for testing than old tuberculin. In this Report the authors have recorded the results of experiments undertaken to elucidate some of these points.

The large dose of tuberculin necessary for testing cattle, the double intradermal test, and also the necessity, on occasions, for repeating tests at short intervals, all produce problems which do not normally arise in medical work, but which may be of paramount importance in eliminating sources of bovine infection.

Conclusive experiments have been carried out by the authors to show the fallacies which may arise as the result of variations in skin sensitivity in the vicinity of recent intradermal tests, and the possibility of sensitising non-tuberculous cattle by repeated tests with unheated tuberculin.

Experiments on the development of sensitivity of tuberculin in animals inoculated with non-tuberculous organisms and the results on skin sensitivity of infection by the avian bacillus are recorded. Attempts to render infected cattle insensitive to skin tests by subcutaneous or intravenous injection of tuberculin have been investigated, but the authors were able to show that cattle could not be satisfactorily "doped" in this way.

It is interesting to learn that in this field of investigation, as in medical work, synthetic medium tuberculin has advantages over old tuberculin, specially owing to the fact that non-specific reactions are less marked with the former and therefore cause less confusion in the interpretation of results.

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